Compositionality and the Theory of Argument Selection

James Pustejovsky

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Lecture 3. Applications of the Theory of Selection
Outline

- Inherent versus Selectional Polysemy
- Classifier Constructions and Selection
- Spatial Prepositions: the case of *at*
- Derived Agency: Cocomposition
Review of Compositional Mechanisms

Where have we gotten ourselves . . .
Maintaining Compositionality

- **Generative Mechanisms of Argument Selection:**
  - Selection
  - Accommodation
  - Coercion:
    (i) Introduction
    (ii) Exploitation

- **Qualia-based Type Structure:**
  - Natural,
  - Artifactual,
  - Complex.
Generative Mechanisms of Argument Selection

• **Pure Selection**: The type a function requires is directly satisfied by the argument.

• **Accommodation**: The type a function requires is inherited by the argument.

• **Coercion**: The type a function requires is imposed on the argument type. This is accomplished by either:
  – **Exploitation**: selecting part of the argument’s type structure to satisfy the function’s typing;
  – **Introduction**: wrapping the argument with the type the function requires.
Difficult Cases of Selection

Co-compositional Selection:

- The derived verb type and meaning is dependent on the type of its argument.
- This violates basic principle of functional typing.

Disambiguating open:

(a) If the object is an entity, then when it’s open, it can be used for its purpose.
(b) If the object is an event, then it begins.

Co-compositional Selection:
(1)a. Mary opened the letter from her mother.
    b. The rangers have opened the trail for the summer.
    c. John opened the door for the guests.

Typically, when “The door opened”, someone comes through the door.

(2)a. Mary broke the teapot this morning.
    b. Federica’s television broke during the Oscars.
    c. Mary broke the stick in two.
Compositional Selection in Prepositions

Types of Locations

- **Natural Location**: defined by 3-D coordinates
- **Artifactual Location**: defined by Telic on Natural
- **Complex Location**: defined by coherence relation with Physical Entity
Natural Locations

From the abstraction of spatial coordinates, there are entities which have spatial denotations without entity extension. $e_{NL}$ is structured as a join semi-lattice, $\langle e_{NL}, \sqsubseteq \rangle$;

(3)a. point, spot, position, area
   b. space, sky
Artifactual Locations: $e_{AL}$

\[(4)a. \, x : e_{NL} \otimes T \, \tau \]
\[\text{b. } g \vdash x : e_{NL} \otimes T \, \tau \overset{=}{=} df \quad g \vdash x : e_{AL} \]
\[\text{c. } g \vdash P : e_{NL} \otimes T \, \tau \rightarrow t \overset{=}{=} df \quad g \vdash P : e_{AL} \rightarrow t \]

Examples of types in $e_{AL}$.

\[(5)a. \, \text{seat: } loc \otimes_T \text{ sit} \]
\[\text{b. home: } loc \otimes_T \text{ live_in} \]
Complex Locations: $e_{CL}$

(6)a. $g \vdash x : \sigma \bullet \tau =_{df} g \vdash x : e_{CL}$

b. $g \vdash P : (\sigma \bullet \tau) \rightarrow \tau =_{df} g \vdash P : e_{C} \rightarrow \tau$

Examples of types in $e_{CL}$.

(7)a. door: $\text{phys} \bullet \text{loc} \otimes_{T} \text{walk\_through}$

b. window: $\text{phys} \bullet \text{loc} \otimes_{T} \text{see\_through}$
Closer Look at the Data

Consider the physical objects from $\mathcal{E}$:

1. **Natural Types** (No Selection):
   - rock, tree, tiger
     
     *We’ll meet up with you at the tigers.*

2. **Artifactual Types** (Partial Selection):
   - blackboard, computer, table, bar, sink, stove,
   - garage, station, park, museum, restaurant

3. **Complex Types** (Selection):
   - door, window, room, pool
Non-selecting Artifactual Entities

1. train, chair, phone, garage, kitchen, sofa, bed
2. But...
   on the sofa, in bed, on the phone, ...
Dot Objects with Functions

Consider the objects from \( C \):
school, work, hospital

1. **Stage-level**: at (the) school
2. **Individual-level**: in school, in the army
Events as Containers

Consider the events from $\mathcal{R}$:

1. **Symmetric**:
   - party, conference, workshop, meeting, battle, breakfast
2. **Asymmetric**:
   - lecture, talk, concert
Degree of Involvement

Symmetric event in the container:

(8) a. John is at a meeting
    b. Mary is at an appointment.

Asymmetric event in the container:

(9) a. John is at a lecture. (he’s not giving it).
    b. * John is at his lecture.
    c. John is at a concert. (He’s not performing).
The Selective Force of Locative AT

(10) a. Any Locative Type from Entity Domain:
   b. Some physical objects from Entity Domain:
   c. Some Events from Relation Domain:
The Semantics of Locative AT

(11) a. Locative Relation is proximity along horizontal dimension.
    b. Telic property of the location or object is exploited.

(12) a. $x : e_{NL} \otimes T \tau$
    b. $g \vdash x : e_{NL} \otimes T \tau = df \quad g \vdash x : e_{AL}$
    c. $g \vdash P : e_{NL} \otimes T \tau \rightarrow t = df \quad g \vdash P : e_{AL} \rightarrow t$

Artifactual Locative Relations

(13) at: $e_{AL} \rightarrow (e \rightarrow t)$
Locative Selection

Location Types:

\[(14) \quad \lambda x \lambda e \exists y [\text{loc}(x, y) \land \text{sit}(e, x, y) \land \text{seat}(y)]\]
Artifactual Locative Coercion

Objects are coerced to Locations

at the table

(16)

\[ \Theta[phys \sqsubseteq loc] : phys \rightarrow loc \]

(18) \[ \lambda x \lambda e(\nu y)[loc(x, y) \land Telic(e, x, y) \land table(y)] \]
Violations of Selectional Constraints

- **at the chair**: locative relation is violated.
- **at the tree**: Artifactual (Telic) constraint is violated.
Catalan Locatives (p.c. Roser Sauri)

(19) On són les claus?
    where are-3pl the keys?

(20) Són a la cadira de lentrada.
    Are-3pl at the chair of the hall.

(21) al despatx/cuina /menjador
    in-the office /kitchen /dinning room

(22) al calaix.
    in-the drawer.
(23) a /sobre la taula.
at/over the table.

(24) where is-3sg the cat?

(25) El gat sobre la taula.
    *El gat a la taula.
The cat is on the table.

(26) where is-3sg the cup?

(27) sobre la taula.
a la taula.
on the table.
(28) És al telfon (, parlant amb la Maria).
    Is-IND.LEVEL at-the phone (, speaking with the-
    SG-FEM Mary )
    He is on the phone.

(29) Està parlant per telèfon (amb la Maria).
    Is-STAGE.LEVEL speaking for phone (with the-
    SG-FEM Mary)
    He is speaking through/by the phone .
    *Est per telfon.
(Data from David Wilkins (2000))

(30)a. *thipe*: flying, fleshy creatures;
    b. *yerre*: ants;
    c. *arnε*: ligneous plants;
    d. *name*: long grasses;
    e. *pwerte*: rock related entities.
Classifier Systems and Coercion

(31)a. kere: game animals, meat creatures;
   b. merne: edible foods from plants;
   c. arne: artifact, usable thing;
   d. tyape: edible grubs.

(32)a. kere aherre: kangaroo as food;
   b. merne langwe: edible food from bush banana;
   c. pwerte athere: a grinding stone
Type Distinctions

(33) a. **SPECIFIC NOUN**: sortal classification, a Natural type;

b. ** GENERIC NOUN**: a Artifactual type;

c. **CLASSIFIER CONSTRUCTION**: the instantiation and binding of the qualia role from the Artifactual type onto the Natural Type.
Natural vs. Functional

(34) *Iwerre*-ke *anwerne aherre arunthe-∅* *are-ke.*

way/path-DAT 1plERG kangaroo many-ACC see-pc

“On the way we saw some kangaroos.”

(35) *the imarte arratye kere aherre-∅* *arlkwe-tye.lhe-me-le.*

1sgERG then truly meat kangaroo-ACC eat-GO&DO-npp-SS

‘When I got there I ate some kangaroo meat.”
Classifier Construction

(36)

\[
\begin{array}{c}
kangaroo \otimes eat_T \\
\otimes eat_T \\
kere & \text{aherre}
\end{array}
\]

\[
\begin{bmatrix}
\text{see} \\
\text{CAT} = \text{verb} \\
\text{ARGSTR} = \begin{bmatrix}
\text{ARG1} = animal \\
\text{ARG2} = \text{phys}
\end{bmatrix}
\end{bmatrix}
\]
Artifactual Selection with Classifier Construction

\[
\begin{aligned}
\text{eat} \\
\text{CAT} &= \text{verb} \\
\text{ARGSTR} &= \begin{cases}
\text{ARG1} = \text{animal} \\
\text{ARG2} = \text{phys} \otimes \text{eat}_T
\end{cases}
\end{aligned}
\]

\[\Theta[kangaroo \sqsubseteq \text{phys}] : kangaroo \rightarrow \text{phys}\]
Accounting for Agency

1. Selection: \( x \) assassinated/murdered \( y \)
2. Accommodation: \( x \) rolled down the hill
3. Coercion: \( x \) flies to Boston

- Human is a complex type of rational animal.
- human: \( \text{anim} \otimes A, T (E, E') \)

(37) a. The child /storm / tree killed the teacher.
    b. The child /*storm / *tree murdered the teacher.
(38) a. \textit{kill}: \textit{anim} \rightarrow (e_N \rightarrow t)
b. \textit{murder}: \textit{anim} \rightarrow (\textit{human} \rightarrow t)
Selection of Agency

John murdered Mary.

1. **murder**: \( \lambda x [\text{murder}(x,m)] \),
   \( \langle m : \text{anim}, x : \text{anim} \otimes_{\mathcal{A},\mathcal{T}} (E,E') \rangle \)

2. **john**: \( \text{anim} \otimes_{\mathcal{A},\mathcal{T}} (E,E') \)

3. \( \exists e [\text{murder}(e,j,m)] \), **Intentional Act**
Accommodation of Agency

John killed Mary (intentionally).
Co-Composition

Classic Co-composition cases:

(39)a. John baked a potato.
    b. John baked a cake.

(40)a. The bottle is floating in the river.
    b. The bottle floated under the bridge.

(41)
\[
\begin{align*}
\text{float} \\
\text{ARGSTR} &= \left[ \text{ARG1} = \square[\text{physobj}] \right] \\
\text{EVENTSTR} &= \left[ \text{E}_1 = \text{e}_1: \text{state} \right] \\
\text{QUALIA} &= \left[ \text{AGENTIVE} = \text{float}(\text{e}_1, \square) \right]
\end{align*}
\]
\[(42)\]

\[
\text{ARGSTR} = \begin{bmatrix}
\text{ARG1} &= \square [\text{physobj}] \\
\text{ARG2} &= \square [\text{the_cave}]
\end{bmatrix}
\]

\[
\text{EVENTSTR} = \begin{bmatrix}
\text{E}_1 &= \text{e}_1: \text{process} \\
\text{E}_2 &= \text{e}_2: \text{state} \\
\text{RESTR} &= \prec \infty \\
\text{HEAD} &= \text{e}_2
\end{bmatrix}
\]

\[
\text{QUALIA} = \begin{bmatrix}
\text{FORMAL} &= \text{at}(\text{e}_2, \square, \square) \\
\text{AGENTIVE} &= \text{move} (\text{e}_1, \square)
\end{bmatrix}
\]

\[(43) \lambda x \lambda e_1 \exists e_2 [\text{move}(e_1, x) \land \circ(e_1, e_2) \land \text{float}(e_2, x)] \Rightarrow \text{while floating}\]

\[(44)\]

\[
\text{ARGSTR} = \begin{bmatrix}
\text{ARG1} &= \square [\text{physobj}] \\
\text{ARG2} &= \square [\text{the_cave}]
\end{bmatrix}
\]

\[
\text{EVENTSTR} = \begin{bmatrix}
\text{E}_1 &= \text{e}_1: \text{state} \\
\text{E}_2 &= \text{e}_2: \text{process} \\
\text{E}_3 &= \text{e}_3: \text{state} \\
\text{RESTR} &= \prec \infty (e_2, e_3), \circ \infty (e_1, e_2) \\
\text{HEAD} &= \text{e}_3
\end{bmatrix}
\]

\[
\text{QUALIA} = \begin{bmatrix}
\text{FORMAL} &= \text{at}(\text{e}_3, \square, \square) \\
\text{AGENTIVE} &= \text{move} (\text{e}_2, \square), \text{float} (\text{e}_1, \square)
\end{bmatrix}
\]
\[
\begin{align*}
\text{kill} \quad & \quad \text{EVENTSTR} = \begin{cases} E_0 = e_0: \text{state} \\ E_1 = e_1: \text{process} \\ E_2 = e_2: \text{state} \\ \text{RESTR} = \prec_\infty \\ \text{HEAD} = e_1 \end{cases} \\
\text{ARGSTR} = \begin{cases} \text{ARG1} = \square \text{ind} \\ \text{FORMAL} = \text{physobj} \\ \text{ARG2} = \square \text{animate}_\text{ind} \\ \text{FORMAL} = \text{physobj} \end{cases} \\
\text{QUALIA} = \begin{cases} \text{cause-lcp} \\ \text{FORMAL} = \text{dead}(e_2, \square) \\ \text{AGENTIVE} = \text{kill}_\text{act}(e_1, \square, \square) \\ \text{PRECOND} = \neg \text{dead}(e_0, \square) \end{cases}
\end{align*}
\]
Accommodation of Agency

1. \( \text{kill}: \lambda x[\text{kill}(x,m)], \langle m: \text{anim}, x: \text{anim} \rangle \)

2. \( \text{john}: \text{anim} \otimes_{A,T} (E, E') \)

3. Agent Accommodation: \( \lambda x[\text{kill}(x,m)], \langle m: \text{anim}, x: \text{anim} \otimes_{A,T} (E, E') \rangle \)

4. Function Application:

5. \( \exists e[\text{kill}(e, j, m)] \)

(45)
\[ S: \exists e[\text{kill}(e_2, j, m) \land \text{Telic}(e_1, e_2)] \]
(46) a. John killed the flowers accidently / intentionally.
   b. John/the rock rolled down the hill.
   c. John cooled off with an iced latte.

(47) a. John gave Mary a book.
   b. John gave Mary a shower.
   c. John gave the plants a spray.
(48)a. We painted \( R(i,j) \) our house last summer. 
    \( \text{We}_i/\text{They}_j \) used Benjamin Moore paints. 
    \( \text{They}_j/*\text{We}_i \) even worked in the heat of the day.

b. I dry-cleaned \( R(i,j) \) my shirts before I left on the trip. 
    \( \text{They}_j/*\text{I}_i \) stained the sleeve, though.

e. I washed \( R(i,j) \) my car yesterday. 
    \( \text{They}_j/*\text{I}_i \) waxed the exterior too.

(49)a. Lufthansa flies to Boston.

    b. McDonalds has served 1 trillion burgers.
Contractual Co-composition

(a) Activities that are contractual between two parties, one in the service of the other; Primary agent $A_1$ performs an activity in the service of secondary agent $A_2$.

(b) The controlling (secondary) agent assumes grammatical prominence as subject. The primary agent is shadowed.
Agent Introduction

(50) Lufthansa flies to Boston.

(51) $S: \text{Gen}(e_1, e_2) \left[ \text{control}(e_1, L, e_2) \land \exists x \left[ \text{fly}_to(e_2, x, B) \right] \right]$

Diagram:

```
NP $^{e_C \otimes T \tau}$ VP: $e_N \rightarrow t$
```

Lufthansa $V$ $PP$

flies to Boston
Difficult Cases

There is no indirect (coerced) interpretation available for most predicates...

• Nixon bombed Hanoi.
• !Clinton kissed all the children.
• !John kicked the dog.
• !Clinton visited Hanoi.
(52)a. **publish**: “$x$ brings into print form an informational object $y$”

b. informational objects have creators;
   e.g., $\lambda^* z \lambda y.\text{human}[\text{letter}(y) \land \text{author}(z, y)]$

(53)a. The New York Times$_i$ publishes a daily newspaper$_i$.


(54)a. Chomsky published yet another book recently.

b. Eno has finally released a new album.
c. McCartney has issued a new version of “Blackbird.”

WordNet synset under: *bring out, issue, release, publish*

Instrument Control

(a) Activities performed by a tool or instrument, that are controlled by an agent; Primary instrument I performs an activity under control of agent A.

(b) The controlling agent assumes grammatical prominence as subject. The instrument is shadowed.

(56)a. I visited your webpage yesterday to download a file.
   b. My students crawled the CNN.com site and indexed the newsfeed headers.
Licensing Purpose and Rationale Clauses

(57) a. Mary\textsubscript{j} bought a pizza\textsubscript{i} \textsubscript{e\textsubscript{j}} to eat \textsubscript{e\textsubscript{i}} at home.
    b. Roger\textsubscript{i} bought a Hummer \textsubscript{e\textsubscript{i}} to impress his friends.

(58) What is the difference between purpose and rationale clauses?

a. **Purpose Clause:**
   1. Adjunct is the **Telic** of the matrix event.
   2. Object argument coherence is required.
   3. Subject control.

b. **Rationale Clause:**
   1. Adjunct is **Telic** for the matrix event.
2. No object argument coherence.
3. Subject control.

(59) a. Everyone bought a book to read to a child.
    b. Everyone bought a car to impress a friend.
(60) \[ \lambda x \lambda e \exists y \begin{bmatrix} \text{VP} \\ \text{ARGSTR} = \begin{cases} \text{ARG1} = x \\ \text{ARG2} = y : \text{pizza} \end{cases} \\ \text{EVENTSTR} = \begin{cases} E_0 = e : \text{transition} \end{cases} \\ \text{QUALIA} = \begin{cases} \text{FORMAL} = \text{have}(x,y) \\ \text{TELIC} = \text{eat}(x,y) \\ \text{AGENTIVE} = \text{buy-act}(x,y) \end{cases} \end{bmatrix} \]

(61) The “outer TELIC” relation is Asher and Lascarides’ *Elaboration* relation.
(62) Inner TELIC can be embedded within outer TELIC: Roger bought a Hummer to drive to work to impress his teammates.

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<tbody>
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<td>$j, bmw, e$</td>
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<td>$\pi : buy(e, j, bmw)$</td>
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<table>
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<th>$\pi_1$</th>
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<tbody>
<tr>
<td>$e', y$</td>
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<tr>
<td>$\pi_1 : impress(e', j, y)$</td>
</tr>
<tr>
<td>$friend(y)$</td>
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$Elab(\pi, \pi_1)$
Corpus Data on Selection: believe [___ S+-fin]

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Corpus Data on Selection: believe [__ NP]

- luck 73 33.05
- ear 48 22.14
- story 73 20.67
- word 95 18.9
- eye 74 14.78
- hype 6 14.16
- myth 12 14.07
- truth 19 13.39
- it 8 12.91
- lie 10 12.57
- opposite 7 12.22
- tale 13 12.16
- nonsense 7 11.62
- propaganda 7 11.17
Concordance for believe [__ NP]:

31 percent said they'd believe the newspaper, primarily because they had "more

He seems to have made the mistake of believing his own propaganda.

Politicians are always at their most vulnerable when they believe their own propaganda.

They weren't quite so stupid as to believe wholly their own propaganda.

The trouble with the hon. Gentleman is that he believes his own propaganda.

The trouble is, the media is able to influence the public and unfortunately influential people in the trade union and labour movements, and maybe they believe the propaganda that socialism is dead and respond accordingly.
PropBank: doubt

Predicate *doubt*:

*Frames file for 'doubt' based on sentences in financial subcorpus. No access to verbnet. Comparison with 'believe'.*

Roleset doubt.01 "doubt, disbelieve":

Roles:

- **Arg0**: disbeliever
- **Arg1**: disbelief

Examples:

sentential disbelief (-)

> Although takeover experts said they doubted Mr. Steinberg will make a bid by himself...

- **Arg0**: they
- **REL**: doubted
- **Arg1**: Mr. Steinberg will make a bid by himself

*As usual, leave 'that' complementizers out of the Arg1.*

nominal disbelief (-)

> John doubted Mary.

- **Arg0**: John
- **REL**: doubted
- **Arg1**: Mary
Corpus Data on Selection: doubt [__ NP]

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Corpus Data on Artifactual Selection: repair [__ NP]

- damage: 107, 42.92
- roof: 16, 20.31
- covenant: 9, 18.38
- fence: 10, 18.1
- gutter: 5, 15.89
- ravages: 4, 15.82
- hernium: 4, 15.6
- car: 23, 15.39
- shoe: 10, 15.04
- leak: 5, 15.01
- bridge: 10, 14.03
- crack: 6, 14.02
- fencing: 4, 13.91
- wall: 14, 13.77
- puncture: 3, 13.54
- building: 16, 13.52
- pipe: 7, 12.92
- saddlery: 2, 12.79
- ligament: 3, 11.85
- road: 13, 12.24
## Corpus Data on Complex Selection: read [__ NP]

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- lie 254 45.4
- tale 275 41.0
- reporter 170 38.53
- inquest 82 34.16
- court 639 33.72
- Reuter 44 33.62
- conference 288 30.81
- fib 18 30.49
- joke 94 28.63
Corpus Data on Polysemous Alternating Verbs: open:

Before Bramble could answer, the door **opened** and another stranger entered. As he hesitated the door **opened** and Gilbert Forbes came out in a rush, Dressing-room doors **opened**, voices questioned, feet clattered on and when the door **opened** again he started violently and spilled. It turned. He pulled. The door **opened**. He looked out. The corridor dusky. But midway through the afternoon the door **opened**. Pike came in. x x The bedroom door **opened** and she rushed in. `What want anything. The door **opened** and there she stood. She was wearing a they sang as the back door **opened** and Nick came in, a bottle of wine in but then the door **opened**. The policeman smiled showing large flashy then the door **opened**. A Bengali girl, absurdly young, stood. The door **opened** and Sheila came in. `What are still searching for them as the front door **opened** and Herr Nordern came in.
Corpus Data on Complex Types: lunch (as Obj)

- eat 93 42.49
- cook 34 34.46
- serve 44 28.44
- skip 9 23.41
- finish 21 22.58
- enjoy 25 21.97
- prepare 21 20.66
- attend 15 18.54
- miss 12 16.96
- take 48 15.47
- provide 26 15.21
- bring 21 15.06
- get 40 14.98
- include 12 10.89

- buy 14 14.21
- arrange 8 13.18
- want 19 12.69
- host 4 12.17
- organise 6 11.1
- cancel 4 11.08
- order 6 10.74
- spoil 3 9.72
- share 6 9.75
Corpus Data on Complex Types: lecture (as Obj)

- attend 75 38.84
- deliver 65 38.02
- give 226 35.18
- entitle 12 19.41
- organise 9 14.38
- present 13 14.16
- sponsor 5 12.55
- illustrate 7 12.44
- finish 7 11.81
- include 13 11.4
- organize 5 11.21
- publish 8 10.99
- prepare 7 10.52
- get 22 9.82
- record 6 9.73
- hold 12 9.55
- arrange 5 9.46
- read 6 8.59
- write 8 8.54
- begin 6 6.4
Corpus Data on Complex Types: seminar (as Obj)

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